CASE STUDY SUMMARY

ENLACES: BUILDING A NATIONAL LEARNING NETWORK

Linking Chilean Teachers & Students for Better Education

by Eric Rusten, Eduardo Contreras-Budge and Dominica Tolentino

January 1999 Update

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Enlaces: Building A National Learning Network

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LearnLink case study summaries provide a brief overview of development projects that illustrate how information, education, and communication technologies have been and are being used to enhance education programs and other learning systems around the world. They focus on drawing lessons and distilling basic principles from projects that LearnLink staff believe are germane to planning and implementing similar projects. The summaries are not intended to be comprehensive case studies or project reports.

This summary, like other summaries in this series, reviews an ongoing project. It will be periodically updated to reflect changes in project activities, achievements and learning.

I. Project Summary

Enlaces is a bold initiative that is radically expanding and enhancing learning environments and educational opportunities for Chile's students and teachers. Using a creative mix of computers and communication tools, *Enlaces* is creating a virtual community of teachers and students across Chile and linking this network to the rest of the world via the Internet.

Enlaces is part of a nation-wide education reform effort that seeks to improve the equity, quality, and efficiency of primary and secondary education. *Enlaces,* which means linkages in Spanish, began in 1992 as a pilot effort by a small group of people at the Catholic University of Chile in Santiago. The project's initial goal was to see if a combination of computer and communications technologies could be used to connect schools to form a small learning network. Project planners believed that a network linking schools could contribute to better teaching and learning, help teachers and students to develop new skills, and initiate new ways of learning and applying knowledge.

Pedro Hepp

La Plaza*, the computer interface for *Enlaces

After demonstrating a high degree of success, the *Enlaces* prototype was adopted by the Ministry of

Education in late 1993 to become a nation-wide initiative as part of the national education reform program, MECE (Improvement of Equity and Quality of Education). *Enlaces* and the larger reform effort share important, mutually-reinforcing relationships which are critical to overall success. By modernizing the education system, government officials believe that Chile will sustain economic growth and social development, and be an active participant in the global information economy of the 21st century.

By the end of the 1998 academic year, more than 3,000 primary and secondary schools and half of all primary and secondary students (1.4 million) will be participating in the *Enlaces* program. The Ministry expects that all secondary schools and half of Chile's primary schools will be linked by the year 2000. The remaining primary schools, covering 11 percent of all students, are in remote rural areas not served by the telecommunications infrastructure. Linking these schools to *Enlaces* remains a priority of the Ministry, and a variety of creative approaches to solving the challenge of providing these schools with basic communication services are being planned.

The *Enlaces* project has the following main objectives:

- Establish a virtual education community of teachers and students using a computer-mediated communications network linking all primary and secondary schools in Chile. This network, as explained by Cristian Cox, MECE's Director, is "a communication network that radically expands the schools' learning environments."
- Enable all teachers and students in Chile's primary and secondary schools to have equal access to basic entry-level computer and communications technology and related educational resources, regardless of location or socio-economic status.
- Improve teaching practices to increase learning.
- Teach students to conduct research, process information, and improve planning skills; stimulate creativity; and build effective communication abilities.
- Improve the administration and maintenance of student records and instructional materials.
- Enable teachers across Chile to share educational resources and engage in collaborative learning.
- Provide teachers across Chile with a forum to share innovative ideas and experiences.
- Prepare students for the modern workplace by teaching them to use computers and related information and communication technologies (ICTs).

In concert with these educational objectives, there are economic and social expectations as well. Students from *Enlaces* schools will likely become agents of change, introducing ICTs in other sectors of Chilean society as tools for learning and

development. These skilled graduates will also provide for sustained national economic growth and development.

Pedro Hepp, National Coordinator of the Ministry's *Enlaces* program, started and directed the pilot project with a small cadre of committed professionals. Hepp and his team linked 81 primary schools in 1994, and prepared a proposal for World Bank support to expand the network to secondary schools. At the end of 1996, Ministry and World Bank funding enabled *Enlaces* to link 350 primary schools and 165 secondary schools, and by August 1998, over 1,500 schools, supported by a network of 35 universities, were part of *Enlaces*, with 1,700 more schools expected to be linked by the end of 1998, and another 1,500 during 1999. The program's goal of linking all of Chile's secondary schools (about 1,400) and half of all primary schools (about 4,125) by 2000 may be achieved, though more private-sector support will be needed for full implementation.

Enlaces is both a physical and social network linking Chile's educational institutions. The physical network includes computers in schools with links to universities for technical support, a telecommunications infrastructure, and software, and communication resources. Users access the resources and services through a locally developed interface known as *La Plaza*, meaning "a town square." The *La Plaza* interface, shown above, represents a common cultural setting familiar to anyone in Chile. Users simply "click" on parts of *La Plaza* to access their email accounts, information and reference materials, a number of educational software packages, a chat room for interactive discussions with others on the network, and a bulletin board for school and community announcements.

Most communication among *Enlaces* members is carried out along standard telephone lines via a store-and-forward email method where schools dial out to regional nodes late at night when rates are low and then accumulated messages are forwarded to their destination. To address problems faced by some schools that cannot join *Enlaces* due to a lack of telephone service, project staff are experimenting with packet radio modems to transmit email to and from schools. *Enlaces* does not provide schools with real-time access to the Internet, but some schools have established these services on their own. In 1998, *Enlaces* staff started addressing the question of providing schools with full Internet access as an educational tool, even though its own Web site, which was enhanced in August 1998, has existed since 1995.

The social network consists of primary and secondary school administrators, teachers, students, universities, and staff and officials of the Ministry of Education. The Ministry oversees *Enlaces'* policies, guidelines, and funding, and a consortium of 35 universities in different regions of Chile provides technical support and teacher training. *Enlaces* is headquartered at the Universidad de la Frontera (UFRO) in Temuco, Chile. A project team of approximately 40 professional and support staff are distributed in the different regions to manage and support project activities.

Enlaces is funded by the Chilean Government, through the Ministry of Education, with additional assistance from World Bank loans. According to Potashnik (1996), Chile expects to spend approximately $80 million on *Enlaces* until the year 2000, including a Word Bank loan for $20 million. Communities, schools, and businesses also provide some cash and in-kind contributions for local *Enlaces* schools. About three-quarters of the funds are earmarked for equipment, and the remainder is for training and technical support. Ministry officials realize that long-term sustainability of *Enlaces* will require private sector involvement, and they are actively campaigning for resources from businesses and offering tax benefits to encourage donations to *Enlaces* schools. Hepp (1998) reports, however, that few businesses have been willing to provide sizable contributions because of the lack of strong incentives and inexperience with this kind of public-private partnership.

Apple Computer Corporation donated some initial equipment through its Apple Classrooms of Tomorrow (ACOT) program and Apple's Chilean distributor won the initial public bid to provide *Enlaces* with equipment. ACOT also provided consulting services and advice and training to teachers and *Enlaces* staff. After becoming a national program, both IBM Corporation and Apple won major contracts to provide *Enlaces* with equipment. The combination of IBM and Apple computers and equipment makes it more difficult and costly to manage and maintain *Enlaces*' technology base.

One of Chile's major telecommunications companies, CTC, is donating 5,650 telephone lines to *Enlaces* schools, of which 860 are designated for rural schools. CTC will also provide reduced rates for telephone costs, and is offering all government-supported *Enlaces* schools up to 88 hours of free Internet access per month. CTC will also train 10,000 teachers on educational uses of the Internet.

Enlaces is an open learning network, and private schools are encouraged to join *Enlaces* if they provide their own equipment. All schools must pay their own operating and recurrent costs. Telecommunications costs are very low in the *Enlaces* network, but increase if the Internet is used. All schools entering *Enlaces* must prepare proposals for their own educational projects detailing how the technology and the network would be used to enhance education. Once the Ministry approves the school's plans, *Enlaces* provides the necessary equipment. A network of supporting universities train the principal and at least 20 teachers from each school. The trained teachers are then required to train additional teachers in their schools. *Enlaces* also provides schools with additional technical support during the first two years they are part of the network.

Primary schools are allocated equipment and services based on the number of students. Schools with up to 100 students receive three computers and one printer; those with up to 300 students are given six computers and two printers; and schools with more than 300 students receive nine computers and two printers. Each school also receives one modem, one CD-ROM player, and a selection of educational software. Secondary schools are provided with a multimedia computer lab with 11 computers, three printers, a network server and modem, CD-ROM drives, and other multimedia tools and software. Individual schools are responsible for recurrent costs and are encouraged to develop strategies to expand and sustain their new computer and communication systems.

Universities in different regions provide technical assistance and training to schools and teachers participating in *Enlaces*. Along with support, training, and managing the network, the universities also help teachers become self-sufficient in their use of information communication technologies to enhance education and stimulate creativity and innovation. The *Enlaces* National Coordination Office sets basic standards, and each regional center and cluster of affiliates develops its own plans and activities to meet the specific needs and capabilities of the schools in its area. *Enlaces* also publishes a quarterly magazine and has a Web site (www.enlaces.ufro.cl) to provide teachers and others with educational resources and information about *Enlaces*.

Enlaces' most obvious achievement is creating a computer-mediated communications network of teachers and students at hundreds of Chilean schools, universities, other educational institutions, and the Ministry of Education's own programs. This impressive accomplishment has and continues to provide a means of enabling a series of significant and far-reaching benefits, which are outlined below.

Contributes to Chile's National Educational Reform Effort

The Ministry of Education's broad educational reform effort includes initiatives to provide students and teachers with access to modern technology. Through the *Enlaces* project, computers and telecommunication capabilities are introduced directly into Chilean schools to support new learning and teaching practices.

Increases Equity Among Chile's Schools

The Ministry of Education selects schools for the *Enlaces* program according to poverty indicators. *Enlaces* is part of the MECE program, which explicitly addresses equity issues and schools at "pedagogical risk." Since *Enlaces* began, it focused on providing economically and socially disadvantaged schools with computer equipment and training. In fact, a majority of the schools in the small pilot program were among the poorest communities in the country, serving mainly indigenous populations in southern Chile and popular schools in Santiago. Using the La Plaza interface and both locally developed and commercial educational software, *Enlaces* also helped ensure that all teachers and students linked to the network would have access to the same kinds of information, regardless of location. As the program expanded, this equity goal remained a focus of project activities.

Motivates Chilean Society to Support the Program and General Education Reform

The vision of *Enlaces* is to create a national learning network of Chilean schools to improve education and meet the future needs of society. *Enlaces*' focus on modernizing education and its visible achievements have enabled the program to generate broad public and government support. The high level of support from schools, parents, businesses, and politicians makes it easier for the program to obtain practical assistance from all sectors of society, achieve objectives, and solve problems.

Enables Collaborative Links among Teachers and Students in Participating Schools

Enlaces enables teachers and students to communicate easily with others within the network and with people around the world via the Internet. Teachers and students frequently attend meetings, events, and exhibits of locally-produced software applications and computer-assisted educational projects. Simple school projects produced software including "Wordarium," "Guessing the Character," and the "Poetic Dictionary" that are used to increase and enrich collaboration among participants, enhance creativity, and build vocabulary and information processing skills. The network also enables teachers to share their experiences and engage in collaborative problem solving and learning.

Demonstrates that Computer Networks are Beneficial in Preparing Students for the Global Information Economy

Studies carried out by *Enlaces* researchers and UNESCO consultants show a positive change in teachers' attitudes toward teaching, computers, and the benefits of the network after being involved in *Enlaces*. These studies also indicate that student dropout rates have fallen and achievement among slow learners has increased for *Enlaces* schools. Interviews with teachers and students also show an increase in student motivation and creativity. The World Bank, SRI International, the Universidad de La Frontera, and Fundación Omar Dengo (Costa Rica) conducted a major qualitative study of computers in schools serving middle- to low-income students. Six successful *Enlaces* schools in Chile were selected for an in-depth study from June to November 1996. Researchers found that student-teacher relationships within computer labs were more personal than in traditional classrooms, and that students showed greater ability to work and learn independently. Computers have also increased the likelihood of cooperative learning situations. Positive impacts on behavior and self-esteem were also reported, among slow learners and special education students. Teachers also expressed positive impacts on their own behaviors and self-esteem, and believed that computers increased collaboration and strengthened relationships among teachers in the network. Parent and community involvement and interest in computers in schools also increased.

Although the World Bank/SRI report did not intend to draw specific conclusions about student learning, interviews with teachers reflected their belief that computers did enhance thinking skills and the quality of work of their students. The positive changes in behaviors and relationships among students and teachers are thought to be good indicators that some kind of improvement in learning is taking place. However, more focused research on the effect that computers and learning networks may be having on learning is needed to verify and quantify this effect.

Provides an Example of a Working and Evolving National School Computer Network

The *Enlaces* program is cited by The World Bank as an excellent example of a successful education and technology project in the developing world. Chile's experience

represents one possible approach to bringing computers into schools to enhance education, and provides useful lessons and information for understanding the risks and potential benefits of experimental pilot projects that eventually become national programs. Other countries wishing to implement similar programs to introduce computer network technologies in schools can learn from Chile's efforts and accomplishments.

Focus on Teachers and Teaching, not the Technology

Central to the success of educational technology projects is training and supporting teachers, and integrating technology into learning environments. *Enlaces'* staff are convinced that providing ongoing support and training and actively involving teachers in decision-making about using computers and learning networks to enhance education is central to the program's continued success. If teachers are not meaningfully involved in decision-making about technology programs, long-term educational achievements and changes in pedagogy will be unlikely. *Enlaces* staff believe that the effective use of computers by students is also dependent on teachers successfully assimilating education technologies and integrating these new skills into new approaches to teaching and classroom management. Achieving this is dependent on projects building effective support systems for teachers. This not only helps to create the attitude among teachers that technology is an ally for improving teaching and learning, but it also reinforces the idea that technology can be a useful means of enabling educational reform.

Revista *Enlaces*, September 1996

Teacher and students using *Enlaces*

Enlaces' staff learned early that successfully introducing computers to schools depends on emphasizing teacher orientation, training, and ongoing support. The program uses several ways of providing teachers with learning opportunities. These include formal group training at teachers' schools and in workshops, collaborative projects with teachers from different schools, the sharing of teacher experiences with using computers via the project's magazine and web site, and through informal teacher networks. During training, teachers are provided with

"teacher only" rooms to learn and practice new skills. *Enlaces* and other similar projects have learned that teachers do not like learning to use computers while their students are present and will actively avoid training activities if not held in private facilities.

To enhance the rate of adoption in *Enlaces* schools, computers are presented to teachers as general educational tools that all teachers can and should use — not just math or computer science teachers. Training and orientation are aided by having the easy-to-use software interface *La Plaza*. People often fear complex technical systems, and by eliminating the need to learn a series of complex commands, many *Enlaces'* teachers felt that anyone could easily use the system. Once the initial fear of the technology was eliminated, teachers learned more advanced skills quickly and began using the technologies in their classrooms.

Teachers' concerns about being asked to quickly adopt new technologies and ways of teaching influenced program design. Gradually introducing computers to schools with ongoing support and training over the course of two years allowed *Enlaces* to focus on meeting teachers' needs and linking technology to teaching. Teachers and administrators also appreciated the program's focus on using the technology to improve school and classroom administration. Providing teachers with practical tools for handling mundane management tasks allows them more time for more enjoyable educational activities. This feature of the program contributed to teachers adopting new pedagogies that included the use of technology.

In a further effort to address teachers' real needs, the *Enlaces* learning network provides teachers access to email and discussion groups. Teachers' use of the network for communication also made all teachers, even those in poorer schools, feel part of a larger educational community and reduced feelings of isolation so common among teachers in rural areas.

To become part of *Enlaces* all schools must propose educational projects using the new technologies. These teacher-designed projects foster self-reliance and demonstrate how innovative teachers across the network are using the new system to enhance teaching and learning. Designing and implementing their own computer education projects has been an important learning and formative process. These projects and experiences are shared with others through local and regional events, as well as through the Internet. It is pleasing to note that women teachers across all disciplines devised a substantial number of these projects.

A critical factor affecting teachers' ability to become involved in *Enlaces* is the desperate lack of time that teachers have for any extracurricular activities including computer training, self-instruction, skills practice, and intensive collaborative work. The development of required professional skills occurred primarily on a voluntary basis outside the teachers' normal workday. Dependence on teachers' willingness to spend their own time and resources to make technology projects successful should not become the rule. Programs need to provide teachers with sufficient time during their workday for training, practice, and innovative planning.

The *Enlaces* program is evolving and expanding, and now seeks to intensify the relationship between technologies and learning processes, both at a broad strategic level — the restructuring of educational and learning practices — and at the micro level through practical day-to-day applications that improve classroom management and enhance teaching and learning. The greatest challenge facing *Enlaces* and similar programs is to substantively integrate technology into educational processes. This goal is not easy or short-term. Teachers must be given the training, support, and time they need to reflect on the way they have been teaching and to learn how to change.

Enlaces has taken several necessary steps to empower teachers and give them a strong sense of ownership of the program. These feelings of ownership are expressed by a number of teachers who indicate that *Enlaces* is achieving good levels of success. However, more effort is needed to sustain and perpetuate educational change in the use of technology in schools over the long-term.

Use a pilot project to test theories and strategies before implementing them on a large scale

New, complex, and technically difficult initiatives are often best started as small, flexible pilot projects designed to test key ideas, refine strategies, and demonstrate potential. *Enlaces* successfully transitioned from a pilot project to a national program because of its long-term vision and its effectiveness at the pilot stage. Although the *Enlaces* project helped complete the technological requirements for introducing computers into schools, the project itself has focused on educational development. It gained the political and financial support necessary for it to become integrated into a national agenda for improving education. If *Enlaces* had not been integrated into the national educational reform effort, it is unlikely that the program could have achieved its current level of success.

Organize a small, professional, decentralized management team

Although *Enlaces* is part of the Ministry of Education, a fairly small autonomous team of professionals manages the program. Because of the complexity of the *Enlaces* network and its far-reaching goals and objectives, *Enlaces* requires a highly competent professional team to design, manage, and maintain it. Individuals in direct collaboration with the schools make most of the administrative decisions. The autonomous and decentralized nature of the program has attracted leading education professionals to join *Enlaces* as collaborators and promoters. The *Enlaces* experience demonstrates the importance of creating and maintaining a decentralized management structure comprised of committed professionals so that people closest to actual project activities can make decisions that reflect local realities and needs and not central policies.

Utilize a preexisting infrastructure

Projects such as *Enlaces* that seek to create dynamic learning networks using information and communications technologies to connect schools will benefit significantly from a well-developed power and telecommunications infrastructure. The underlying communications and power network in Chile played no small part in the early achievements of *Enlaces*. In poorer rural parts of Chile that lack these resources, the program has experimented with wireless alternatives to provide basic connectivity to participating schools. This demonstrates that an extant infrastructure can make learning network projects easier and faster to implement. However, the absence of a well-developed infrastructure should not preclude such initiatives. For much of the developing world, it may be too expensive and take too long to establish a conventional power and communications infrastructure to reach all communities, especially the poorest and the most remote areas. In such situations, it may be possible to create clusters of linked schools or learning network cells via wireless technologies. Nations considering projects similar to *Enlaces* must carefully evaluate current and planned infrastructures against the demands of technology projects. Such efforts must also assess alternative strategies for meeting these needs, since the long-term benefits of enhancing education through computer -mediated communication will likely outweigh short-term costs.

Gradually introduce computers into schools and integrate the technology into teaching and learning activities

It takes time for teachers and schools to adjust to using computers and communications tools and integrate these technologies into educational programs. *Enlaces* shows that while computers are useful tools, it is necessary to introduce them in ways that are not threatening, allowing teachers, administrators, and students to learn how to use them to improve education and make their work easier and more enjoyable. Change and innovations in educational practices start with methods that are already being used. *Enlaces*' structure allows changes to be gradual and in many ways self-directed by the teachers themselves.

Schools should have sufficient autonomy to define the ways in which technology will be used to support their own educational needs and activities. At the same time, educational technology programs need to use training and demonstration activities to show the diversity of possible applications and new opportunities for local innovation. *Enlaces* has been an exercise in empowerment for teachers and school administrators by encouraging them to develop their own proposals for using computers in their schools. Teachers are the primary actors and beneficiaries of the program. This has given them a sense of ownership of the program, and has built a willingness to implement change. By sharing their experiences with others, teachers gain self-efficacy and self-reliance.

Although the training *Enlaces* provides is enough to familiarize teachers with the use of technology, it is insufficient to allow teachers to fully integrate technology into their curricula. Enabling local innovation is difficult to achieve, but some teachers will likely find

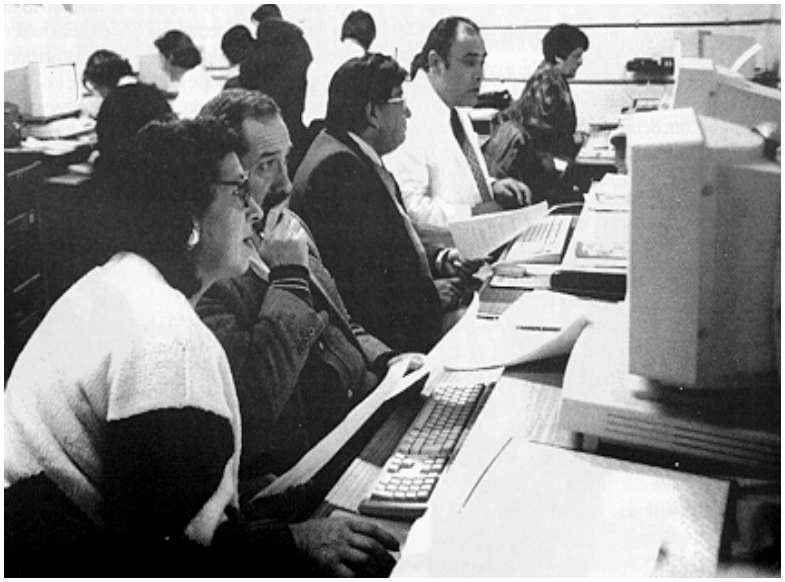
novel ways of effectively integrating computers into their lessons and will hopefully use the network to share their successes. Initial and continuous training is essential to develop skills, confidence, and a desire for innovation. Although schools are provided with the necessary equipment and infrastructure, teachers must be willing and able to use these tools if they want to help their students learn new capabilities effectively. The gradual introduction of technology into schools, the design of a culturally appropriate and an easy-to-use interface, and on going support has been essential for the success of projects like *Enlaces*.

Decentralize technical assistance and training

Much of the technical assistance provided by the universities consists of providing teacher training, and producing work guides and training materials. Using universities in this way has a number of potential advantages. The universities often keep up-to-date on education and technology trends, and they can provide advice on pedagogical matters. This decentralized arrangement also gives the universities and schools more power to define and direct the program to meet their specific educational goals and to implement their own school-based projects. The universities are accountable to the schools and the Ministry for delivering training and technical support, and are free to flexibly apply basic standards set by the Ministry. Universities also have opportunities to conduct research to evaluate the progress of students and teachers in *Enlaces* schools within each zone. Another advantage of this unprecedented arrangement is that universities must deal with the realities of introducing technological innovations and skills into public primary and secondary education.

There are also important disadvantages, however, to using universities to deliver support services to a complex project. Universities may have limited capabilities in keeping computer systems and communication networks running. It may be better to rely on commercial vendors for these types of services when they exist. Universities also usually have slow administrative procedures, rigid bureaucratic systems, high operating costs, and a lack of discretionary financial resources. Even though universities have research capabilities, there are no guarantees that staff will choose to make educational technology projects a focus of inquiry.

Revista *Enlaces*, July 1995



***Enlaces* teachers learning by doing.**

Although universities may not be the best means of providing support, training, and research services to

projects such as *Enlaces*, it seems that for Chile they were the most reliable and efficient way of reaching the schools and teachers in a decentralized mode. A hybrid arrangement with both private and public agencies providing aspects of technical assistance and training may be an effective approach for complex projects. Such an arrangement may also keep costs down, promote community involvement, and encourage economic development.

Use robust processes for assessment, monitoring, and evaluation

Dynamic but not complex monitoring and evaluation strategies and tools to collect both quantitative and qualitative information can make important contributions to the success of education development programs and in maintaining strong local and national support for expensive and long-term reform and development projects.

Enlaces staff devised a strategy for monitoring and evaluating the use of the network by teachers and students, as well as their progress toward achieving short- and long-term project results and outcomes. These approaches included monitoring the use of *La Plaza* software, the flow of communications among schools, the number of email contacts made by participants, and assessing student achievement using the national exam and other instruments. The data collected through this system could provide *Enlaces* with the raw material to identify and explain early usage patterns and changes in attitudes, behavior and learning outcomes related to *Enlaces*. Unfortunately, only initial results from 1995 were reported and no subsequent information was provided in the January 1998 evaluation report.

Project staff carried out a series of small qualitative studies to improve planning and implementation. These studies focused on assessing the concerns and attitudes of teachers, principals, and students about using computers and communication networks to enhance learning. Early results from teachers showed that they were skeptical about the plans for *Enlaces*; many believed that poorer schools would never receive computers, and that if they did they would be old, used systems and that teachers would not be trained to use them. As the project progressed, focus group meetings and interviews indicated that teachers' attitudes toward using technology in the schools were positive.

Teachers also valued the simplicity of the *La Plaza* interface. The electronic resources, although limited, made teachers feel that they were indeed part of the larger *Enlaces* program and a networked community of learners. Many teachers also felt that they were part of a "modern wave" of education improvement in Chile. Student assessments showed that they felt much more motivated to learn in innovative, fun, and engaging ways. They also believed that they were learning marketable skills in writing, computer knowledge, teamwork within their schools and across the network.

A major independent qualitative study carried out in 1997 examined classroom, school, and national-level implementation strategies, and compared these to a similar project in Costa Rica (Alvarez et al, World Bank, 1998). Six *Enlaces* schools were selected to participate in the study, which stressed a number of specific positive changes in

learning and teaching that have occurred as a result of using computers for education and of linking schools together electronically.

The results from these qualitative studies do not allow project staff or others to make definitive conclusions about the effect of *Enlaces* on learning performance. They do, however, provide valuable insights into the multitude of effects that this project is having on teaching and learning in Chile. They are showing that *Enlaces* is having a substantive impact on pedagogy and that the project is making an invaluable contribution to the larger education reform effort. These studies are providing examples of real-life, classroom-level experiences and lessons from *Enlaces* that are of interest to other schools and teachers in and beyond Chile.

The *Enlaces* program devised a complex set of quantitative tools that were designed to assess student progress over time and track changes in teachers' and parents' attitudes and perceptions of the program. The results from this elaborate evaluation process, based in part on factorial analysis, are not interpretable. *Enlaces* staff admit that the most serious complicating factor affecting the evaluation of *Enlaces*' impact on education is the number and pervasiveness of different processes that are involved in the national educational reform effort. It is extremely difficult to isolate the impact that *Enlaces* might be having from the impact of the larger reform program. Additional difficulties derive from the varied way in which schools, teachers and students use *Enlaces* to enhance different aspects of teaching and learning. Notwithstanding such complexities, some comparisons using national achievement scores of *Enlaces* and non-*Enlaces* schools have recently begun.

Sustain and expand technology projects

Development projects that require significant investments in technology demand sound strategies to cover maintenance, replace outdated equipment, fund the purchase of new equipment to meet increased demand, pay recurrent operating expenses, and provide ongoing user training. To address parts of this sustainability challenge, *Enlaces* provides participating schools with all initial equipment and software and two years of technical assistance, during which schools are expected to develop plans and mechanisms for sustaining the project. Early reports indicate that most schools are successfully meeting part of this responsibility. There has been limited success, however, in receiving effective service from equipment vendors and in keeping costs for telephone service and equipment insurance and repair low. The lack of skilled technicians to service both IBM compatible and Apple equipment, especially in remote areas, has proven problematic.

An even greater challenge — the need to replace outdated equipment and buy additional equipment — is rapidly becoming a painful reality. At the time this case study summary was prepared, it appeared that few schools had created budgets or funding mechanisms to both upgrade equipment and software to remain active *Enlaces* participants and buy additional equipment needed to meet the growing demand by students and teachers. This is also the time when *Enlaces* has encouraged schools to discover

the educational possibilities of the World Wide Web, for which monthly access and on-line use costs are significant expenses. For *Enlaces* to be sustained and institutionalized, serious progress must be made by schools and the Ministry to develop an equitable means of funding the purchase and continued use of ICTs in schools over time. School budgets must also be changed to reflect these new needs. Creative partnerships among schools, parent groups, and the business community must be forged to provide supplemental funds required to maintain and buy equipment, provide continuous training and increase Internet and network usage.

IV. Concluding Comments

Enlaces, which is part of a broader educational reform effort, is an ongoing program that is successfully managing a complex transition from a carefully planned and nurtured pilot project to a nationwide effort. Projects like *Enlaces* that seek to achieve national coverage without sacrificing educational equity and quality need to address a number of important factors, including:

- a focus on teachers as the main pedagogical actors and a commitment to supporting their learning needs;
- the careful building of a social network of learners and educators, facilitated by user-friendly technology and decentralized support arrangements;
- respect for schools' autonomy and the decisions they make about using technology to meet local educational needs; and
- a balanced mix of a clear project vision, strategic planning, and efficiency, and needed flexibility and creativity in the face of emerging educational challenges and rapidly evolving technologies.

Two other aspects of the *Enlaces* experience deserve special attention. One is well known, predicated, and frequently perverted; the other is advocated but not always practiced. First, Enlaces staff believe and practice the key notion of putting the needs of learning and learners before technology. Strategic program decisions embody this principle, from extensive and well-budgeted teacher training, to school-directed local projects for using technology, and the inviting interface of *La Plaza*.

Second, *Enlaces* planners have judiciously applied learning from other efforts to introduce and use computers and telecommunications to improve education. Lessons learned in different cultural settings echo through the process of implementing *Enlaces*. One can only hope that *Enlaces* continue to be an innovative and equitable learning network that learns from its own experiences and that of others.

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